

DEEP SEDATION PRIVILEGES STUDY GUIDE

The following Study Guide is provided for physicians eligible to apply for Deep Sedation at LLUMC. The Study Guide is approximately 41 pages, so you may consider printing only the Test and reviewing the appropriate Study Guide on-line.

Once the test has been completed, fax only the test pages to Medical Staff Administration at (909) 558-6053 or extension 66053. A certificate will be issued for the sedation privilege(s) upon successfully passing the test with a score of 45 or better. Please ensure all information is completed at the top of the test(s).

LOMA LINDA UNIVERSITY MEDICAL CENTER & CHILDREN'S HOSPITAL

DEEP SEDATION: A SELF LEARNING MODULE AND COMPETENCY ASSESSMENT

January 17, 2001

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SUBJECT

Sedation and analgesia for therapeutic and/or diagnostic procedures in pediatric, adult, and geriatric patients.

PURPOSE

The purpose of this self-study program is to review national guidelines, hospital policies and protocols for procedure-related sedation, and to review the fundamental knowledge necessary for the safe delivery of procedure-related sedation.

DIRECTIONS

It should take approximately two hours to meet the objectives of these modules. The time involved, however, may vary depending on your background.

1. Read the terminal goal.
2. Read the module objectives.
3. Read the module content.
4. Take the post-test. You should score 90%. If you score less than 90%, review the appropriate sections of the module, then retake the post-test.

TERMINAL GOAL

At the conclusion of this course, the individual should have an understanding of:

- national guidelines for sedation by non-anesthesiologists
- *Loma Linda University Medical Center & Children's Hospital* policies and protocols on procedure-related sedation and analgesia
- the essential components of a pre-sedation evaluation
- recommendations for NPO status prior to procedure-related sedation and analgesia
- the essential elements of monitoring the patient for procedure-related sedation and analgesia
- the pharmacology, complications, side-effects, and contraindications of medications used for procedure-related sedation and analgesia
- airway management and how to care for the patient with a difficult airway
- unique issues of concerns in pediatric and geriatric patients
- criteria for discharge

SUPPLEMENTARY READING

1. Practice Guidelines for Sedation and Analgesia by Nonanesthesiologists. *Anesthesiology* 1996, 84:459-471.
2. Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures. *Pediatrics* 1992; 89:1110-1115.

OBJECTIVES

The learner will be able to:

1. Identify three criteria to be met before a patient may receive procedure-related sedation and analgesia.
2. Describe the differences between moderate and deep sedation.
3. Identify equipment that must be used and/or readily available for a patient undergoing procedure-related sedation and analgesia.
4. Describe the type and frequency of monitoring required for a patient undergoing procedure-related sedation and analgesia.
5. Explain the use of the PARS for determining discharge criteria.
6. Describe the difference between an anxiolytic, an amnestic, an analgesic, and a sedative drug and give an example of each drug.
7. Identify the most common complications that might occur with procedure-related sedation and analgesia.
8. Describe appropriate interventions required for the management of actual or potential complications of procedure-related sedation and analgesia.
9. Know the *Loma Linda University Medical Center & Children's Hospital* policy on "Procedure Related Sedation (M-86)".

INTRODUCTION

Objective: To understand the difference between moderate, deep and dissociative sedation

This self-learning module reviews the management of patients who undergo sedation and analgesia, for procedures that are performed outside the operating room, by non-anesthesia personnel. This course is designed to assist the clinician and hospital personnel to ensure that all of the conditions and resources at *Loma Linda University Medical Center & Children's Hospital* are favorably applied when sedating patients for diagnostic and/or therapeutic procedures. Specifically, this course should help to ensure the safe administration, monitoring, and recovery of all patients receiving sedation for diagnostic and/or therapeutic procedures throughout *Loma Linda University Medical Center & Children's Hospital*.

The safe sedation of patients for diagnostic and/or therapeutic procedures requires a combination of properly trained personnel and suitable physical facilities. Moreover, the appropriate selection of patients, the correct choice and application of drugs, a minimum standard of monitoring, and proper recovery of patients is imperative. Seizures, respiratory arrests, and deaths in a variety of practice settings have occurred when any one of the above factors is deficient.

Sedation is most safely applied when viewed as a continuum, with an understanding that patients may progress unexpectedly from a minimal level of sedation to obtundation, resulting in loss of protective reflexes. Accordingly, sedation is best defined by the level of consciousness, not by the drug or route of administration used to achieve a level of consciousness. The definitions provided herein should be used to determine what standard of care and personnel qualifications must be adhered to when administering sedative drugs.

The distinction between anxiolysis/analgesia and moderate sedation is made to determine if implementation of the sedation protocol is required. The distinction between moderate and deep sedation is made for the purpose of describing appropriate levels of training for personnel, level of monitoring, and anticipated risk. Since the level of consciousness may change with time and patients may exhibit considerable variability in their response to sedatives, practitioners should be prepared at all times to manage a patient who becomes sedated beyond expectations.

A. Minimal Sedation (Anxiolysis): occurs when anxiolytic or analgesic drugs are used for the specific purpose of achieving a state of consciousness in which the patient has diminished anxiety, apprehension, or pain, yet is fully awake and responsive to their surroundings. Examples of anxiolysis and/or analgesia include:

1. Administering narcotics to treat pain.
2. Administering premedication prior to an operative, invasive, or diagnostic procedure.
3. Administering sedative/hypnotics to promote sleep.

When sedative drugs are used in this manner, no sedation protocol is required.

B. Moderate Sedation/Analgesia (Conscious Sedation): central nervous system (CNS) depression produced by titration of sedatives and/or analgesics that allow patients to tolerate unpleasant procedures while maintaining cardiorespiratory function and the ability to respond purposefully to verbal commands or tactile stimuli. Protective reflexes should be intact and the patient should be capable of maintaining a patent airway. This state may be produced by a variety of sedative or analgesic drugs alone, or in combination. An example would be to administer sedatives and/or opiates to facilitate invasive endoscopy procedures.

Anesthetics and deep sedative drugs, including but not limited to the following, should not be administered under this policy: thiopental, methohexital, ketamine, propofol, volatile anesthetics (nitrous oxide is not excluded), sufentanil, alfentanil, and remifentanil.

When sedative drugs result in this level of consciousness, adherence to a MODERATE SEDATION level of care is required.

C. Deep Sedation: a medically controlled state of depressed consciousness or unconsciousness from which the patient is not easily aroused. It may be accompanied by a partial or complete loss of protective reflexes, and may include the inability to maintain a patent airway independently. The defining sign of this state is the inability to respond purposefully to physical stimulation and verbal command. An example would be the administration of sedatives to facilitate a radiological study for a 3 year old child.

Anesthetics, including but not limited to the following, should not be administered under this policy: thiopental, methohexital, propofol, and volatile anesthetics (nitrous oxide is not excluded).

When sedative drugs result in this level of consciousness, adherence to a DEEP SEDATION level of care is required.

D. Dissociative Sedation: a trance-like cataleptic state induced by the dissociative agent ketamine (alone or in conjunction with small doses of a benzodiazepine) characterized by

profound analgesia and amnesia, with retention of protective airway reflexes, spontaneous respirations, and cardiopulmonary stability.

Anesthetics, including but not limited to the following, should not be administered under this policy: thiopental, methohexital, propofol, and inhaled anesthetics.

When sedative drugs result in this level of consciousness, adherence to a DEEP SEDATION level of care is required.

E. **General Anesthesia:** a medically controlled state of unconsciousness accompanied by a predicted loss of protective reflexes, including the inability to maintain a patent airway independently and respond purposefully to physical stimulation or verbal command. An example is to administer nitrous oxide and isoflurane to facilitate surgical procedures.

Only members of the Department of Anesthesiology should administer sedative drugs or anesthetics when this level of consciousness is required.

In summary, the desired level of consciousness when administering sedatives will determine the level and complexity of care that is required.

CURRENT GUIDELINES: PROTOCOLS & POLICIES AT LOMA LINDA UNIVERSITY MEDICAL CENTER & CHILDREN'S HOSPITAL

Objectives:

1. To have an understanding of "*Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists*" and how they might best be adapted to your practice.
2. To have an understanding of "*Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures*" and how they might best be adapted to your practice.
3. To know the operating policy (M-86) of *Loma Linda University Medical Center & Children's Hospital* on Procedure Related Sedation.

Current Guidelines

1. *Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists (Appendix I)*- These guidelines were developed by the Task Force on Sedation and Analgesia by Non-Anesthesiologists of the American Society of Anesthesiologists (ASA). They were approved by the ASA's House of Delegates in 1995 and received subsequent endorsement by the Governing Board of the American Society for Gastrointestinal Endoscopy. It should be noted that the guidelines specifically exclude:
 - a) patients who are not undergoing a diagnostic or therapeutic procedure;
 - b) otherwise healthy patients receiving peripheral nerve blocks, local or topical anesthesia, and/or no other sedative or analgesic agents administered by any route;
 - c) situations when it is anticipated that the required sedation will eradicate the purposeful response to verbal commands or tactile stimulation—"such patients require a greater level of care than recommended by these guidelines".
2. *Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures (Appendix II)*-these guidelines were developed by the Committee on Drugs of the American Academy of Pediatrics. The guidelines were reviewed by all 39 sections of the American Academy of Pediatrics and approved by the Academy in 1992.
3. Operating Policy on *Procedure Related Sedation (Appendix III)*-This policy was most recently revised in 12/00. Clinicians and support personnel should be familiar with and have complete understanding of this policy.

PRESEDATION EVALUATION

Objectives:

1. To have knowledge of the fundamental requirements of a pre-sedation assessment.
2. To understand the ASA Physical Status Classification and to be able to apply this classification system to patients.

All patients receiving moderate or deep sedation will have a preprocedure assessment, within seven days of the procedure by a licensed independent practitioner or resident/nurse practitioner who has completed competency training, as documented by completion of the **Sedation Assessment** (Appendix IV) sections of the *Procedure Related Sedation & Short Stay Record* or its equivalent. This assessment will include: vital signs; history of allergies; history of exposure and/or adverse reaction to sedatives or anesthetics; medical history; including pertinent cardiac, pulmonary, hepatic, and renal disease; and an assessment of overall patient status. The use of the ASA Classification for physical status is required. Provision of monitored anesthesia care with Anesthesiology consultation for patients classified ASA III or higher may be appropriate under some circumstances. Sedation options with attendant risks will be discussed with the patient/guardian and/or family as appropriate. The assessment and discussion will be documented in the medical record. *Non per os* (NPO) status must be evaluated.

The determination that the patient is suitably prepared for procedure-related sedation is the responsibility of the clinician, who is also responsible for the selection of sedative techniques and for the discussion of these choices with the patient. The clinician may choose to consult with other health care professionals to obtain information or services that are relevant to the proposed procedure and sedation plan. The consent for procedure-related sedation should be documented in the pre-sedation evaluation.

Review of Medical Records and Consultations-An assessment of readily accessible, pertinent medical records and consultations should be performed as part of the pre-sedation evaluation. The information should include: 1) diagnoses and reason for procedure; 2) treatments, including medications used; and 3) determination as to whether the patient's medical condition is optimally managed.

Pre-sedation Interview-A patient interview should be performed prior to the administration of sedation. This includes, but is not limited to, a pertinent medical history and discussion of the risks and benefits of sedation choices.

Pre sedation Physical Examination-A pre sedation physical examination should be performed prior to the administration of sedation, the content of which should be determined by the clinician.

Timing of the Pre sedation Evaluation-The timing of the pre sedation evaluation should be determined by the clinician. This determination should be done on a case-by-case basis, depending on such factors as the condition of the patient and type of procedure.

Selection of Pre sedation Tests-The selection of pre sedation tests should be individualized and based upon clinical indications and the judgment of the clinician.

ASA Physical Status Classification-A classification system was designed by the ASA to provide a general description of a patient's physical status. It is used as a preassessment tool to determine a patient's suitability for sedation and/or analgesia. Each clinician should be able to assign an ASA class to each patient. If patients are a physical class III or above, consultation with an anesthesiologist should be considered.

Class	Description	Examples	Suitability for Sedation
I	A normal healthy patient		Excellent
II	A patient with mild systemic disease	Heart disease that slightly limits activity, essential hypertension, diabetes, anemia, obesity, chronic bronchitis	Generally good
III	A patient with severe systemic disease	Heart disease that limits activity, poorly controlled hypertension, diabetes with vascular complications, chronic pulmonary disease that limits activity, angina, history of MI	Increased risk—consider benefits relative to risks
IV	A patient with severe systemic disease that is a constant threat to life	Congestive heart failure, unstable angina, advanced pulmonary, renal or hepatic disease	Poor—consider benefits relative to risks
V	A moribund patient who is not expected to survive	Ruptured abdominal aneurysm, cerebral trauma, massive pulmonary embolus	Extremely poor

NPO STATUS

Objective:

1. To have an understanding of the presented guidelines for pre sedation fasting and how they might best apply to your practice.

Pre sedation Assessment-A review of pertinent medical records, physical examination, and patient interview should be performed as part of the pre procedure evaluation. The interview should include pertinent assessment of gastroesophageal reflux disease, dysphagia symptoms, other gastrointestinal motility disorders, potential for difficult airway, and metabolic disorders that predispose patients to pulmonary aspiration, e.g., diabetes mellitus. Patients should be informed of fasting requirements and the reasons for them in advance of the procedure, and verification of the fasting requirements should be assessed at the time of the procedure. When the guidelines are not followed, the clinician should assess the risks and benefits of proceeding, with consideration given to the amount and type of liquids or solids ingested.

Pre sedation Fluids-Clear liquids may be offered up to two hours before procedures requiring deep sedation without increasing the risks of pulmonary aspiration. Examples of clear liquids include, but are not limited to, water, fruit juices without pulp, carbonated beverages, clear tea, and black coffee. The volume of liquid ingested is less important than the type of liquid.

Pre sedation Fasting (breast milk)-Breast milk may be offered up to three hours before procedures requiring sedation.

Pre sedation Fasting (solids, nonhuman milk, and infant formulae)-Fasting for solids, nonhuman milk, and infant formulae should be for a period of at least six hours prior to elective procedures requiring sedation.

Pre procedure Gastrointestinal Stimulants, Pharmacologic Blockade of Gastric Acid Secretion, Antacids, Antiemetics, or Anticholinergics-The routine use of gastrointestinal stimulants, pharmacologic blockers of gastric acid secretion, antacids, antiemetics, or anticholinergics to decrease the risks of pulmonary aspiration in patients who have no apparent increased risk for pulmonary aspiration is not recommended. Only nonparticulate antacids should be used when antacids are indicated for selected patients for purposes other than reducing the risk of pulmonary aspiration.

Recommended NPO Guidelines

Moderate Sedation

The literature does not support a period of NPO if moderate sedation is anticipated. However, as there will be an expected frequency of deep sedation when the intent is moderate sedation, the clinician may elect to require a NPO period.

Deep Sedation

<u>Ingested Material</u>	<u>Duration of NPO</u>
Clear Liquids	2 hours
Breast Milk	3 hours
Solids, Nonhuman Milk, Infant Formulae	6 hours

Clear liquids, e.g., water, Pedialyte, apple juice, ginger ale, black coffee may be given up to two hours before the procedure.

When proper fasting has not been assured, or in the case of a valid emergency, the decision on NPO status should be made on a case-by-case basis by a privileged practitioner after weighing the risk/benefit ratio. An emergency patient may require protection of the airway against aspiration (intubation) before sedation.

MONITORING

Objectives:

1. To have an understanding of the proper facilities and monitoring equipment for sedation.
2. To have an understanding of complications of sedation, their causes, and the appropriate intervention.

Facilities

1. Procedures performed under sedation should be performed in locations with:
 - a. adequate lighting to observe the patient and monitors.
 - b. sufficient space for personnel, monitoring equipment, and emergency equipment.
 - c. adequate power outlets and clearly labeled outlets connected to the hospital emergency power supply.
 - d. a reliable means of two-way communication to summon help, i.e., telephone or staffed intercom system, with emergency numbers displayed.
 - e. the ability to provide immediate changes in patient position, including the Trendelenburg position.
 - f. a cart or shelf system with adequate space for monitoring equipment in a location where it is easily visible to personnel performing both the sedation and procedure.
2. The resuscitation equipment, a standard hospital code blue cart or its equivalent (with a defibrillator), will be immediately available to the sedation team and recovery area. An intravenous line, if indicated, will be continuously maintained from immediately prior to sedation until the patient has fully recovered from the sedation.
3. The following will also be available:
 - a. a source of oxygen and the devices needed for the delivery of oxygen (i.e., regulators, nasal cannula) and a back-up source.
 - b. a functional self-inflating bag and mask system.
 - c. a functional system to suction the patient.

Monitoring Requirements

1. The patient will be continuously monitored by a licensed physician or appropriate staff other than the person performing the procedure. During the procedure two personnel, at a minimum are required (the privileged practitioner performing the procedure and an assistant competent to monitor designated physiologic variables). Such personnel will be available to the patient from the time of drug administration until recovery is judged adequate or the care of the patient is transferred to personnel performing recovery care.
2. Continuous pulse oximetry, blood pressure, heart rate, respiratory rate, and level of consciousness will be documented before the injection of medication and at least every

5 minutes for deep sedation and every 15 minutes for moderate sedation. In addition, the above should be documented every 15 minutes in the recovery phase.

Consciousness is determined as to whether the patient is fully awake, arousable, or not responding.

3. For moderate sedation, electrocardiogram monitoring may be appropriate for patients with preexisting cardiac disease. In all patients for deep sedation electrocardiogram monitoring is required.
4. Oxygen saturation prior to administration of medications should be documented and provide a baseline for comparison at the end of the procedure. Equipment to administer supplemental oxygen should be present when sedation is administered. If hypoxemia is anticipated or develops, supplemental oxygen should be administered.
5. An assessment of mental status/responsiveness will be continued until the "Criteria for Discharge from Recovery Area" have been met. These criteria include the requirement for monitoring for at least 30 minutes after the last intravenous drug administration or for 90 minutes after the last intramuscular drug administration.

Monitoring is performed with the intention of identifying a complication and applying the appropriate intervention. The following Table lists common complications, possible causes, and appropriate intervention during procedure related sedation.

Complication	Possible Cause	Intervention
Vomiting	<ul style="list-style-type: none"> • crying • full stomach • pain • drugs (narcotics, chloral hydrate) 	<ul style="list-style-type: none"> • <u>patient in lateral decubitus position</u> • assure patent airway • suction • consider antiemetic treatment
Untoward Reactions (agitation, dysphoria, hallucinations)	<ul style="list-style-type: none"> • deep sedation • minimal stimulation • hypoglycemia • hypothermia • drugs (midazolam, narcotics, chloral hydrate) 	<ul style="list-style-type: none"> • assure patent airway • supplemental oxygen • restraints • drug treatment when applicable
Respiratory Depression	<ul style="list-style-type: none"> • airway obstruction • drugs (narcotics) 	<ul style="list-style-type: none"> • assure patent airway • <u>chin lift/neck extension</u> • supplemental oxygen • nasal/oral airway • consider ventilation/intubation • consider reversal agents
Hypotension	<ul style="list-style-type: none"> • bleeding • hypoxia • myocardial depression • allergic reaction • drugs (barbiturates) 	<ul style="list-style-type: none"> • position • fluids • vasopressors • reversal agent • inotropes
Cardiac Dysrhythmias	<ul style="list-style-type: none"> • hypoxia • vagal • pain • hypovolemia • fever • drugs 	<ul style="list-style-type: none"> • assure patent airway • supplemental oxygen • consider ventilation/intubation • drug treatment • CPR • analgesics
Hypothermia	<ul style="list-style-type: none"> • exposure • low birth weight • stress 	<ul style="list-style-type: none"> • warming techniques • supplemental oxygen
Seizures	<ul style="list-style-type: none"> • hypoxia • hypoglycemia • underlying medical condition • fever • drugs (local anesthetics) 	<ul style="list-style-type: none"> • assure patent airway • supplemental oxygen • consider ventilation/intubation • blood sugar • anticonvulsants
Anaphylaxis	<ul style="list-style-type: none"> • drugs • latex sensitivity 	<ul style="list-style-type: none"> • assure patent airway • consider ventilation/intubation • epinephrine • fluids • ACLS • steroids/benadryl/zantac

REVIEW OF DRUGS USED FOR SEDATION: PHARMACOLOGY, COMPLICATIONS, SIDE-EFFECTS, AND CONTRAINDICATIONS

Objectives:

1. To understand the difference between an anxiolytic, an amnestic, an analgesic, and a sedative drug.
2. To know the most common complications that may occur from pharmacologic agents for procedure-related sedation.
3. To know the contraindications for specific pharmacologic agents for procedure-related sedation.

Definitions

Anxiolytic: an agent to reduce patient anxiety. May cause varying degrees of sedation.

Amnestic: an agent to decrease memory for an event. May cause varying degrees of sedation.

Analgesic: an agent to reduce pain. May cause sedation and respiratory depression.

Sedative-analgesic: an agent to provide sedation and reduce or eliminate perception of pain.

Titration: the slow administration of a drug until the desired clinical effect is reached. The goal is to use the smallest effective amount to achieve desired results while lessening the potential for untoward reactions.

For patient information and education, inform them not to perform any duties that require mental alertness and neuromuscular coordination, e.g., driving. The side effects of these medications may vary from patient to patient. Inform patients regarding temporary sedative and amnestic effects of these drugs.

Pharmacological Agents for Sedation and Analgesia

The appropriate pharmacological agent is determined by a number of factors including:

- age of the patient
- type of procedure (painful versus nonpainful; short versus long)
- medical condition of the patient
- need for anxiolysis and/or amnesia
- need for complete immobility
- experience and competency of the practitioner
- cost of the agent

For example, for short procedures not associated with pain, e.g., MRI, CT scan, a sedative may be used. For painful and invasive procedures such as a bone marrow aspiration, a sedative, analgesic, and anxiolytic may all be indicated. Available agents include:

1. Sedatives
2. Non-opiate analgesics
3. Opiate analgesics
4. Other
5. Reversal agents

Sedatives

1. **Barbiturates**-depress impulse transmission within the CNS. They may produce various levels of mood alteration from excitation to mild sedation, hypnosis, or coma. They are void of analgesic properties, and are widely distributed to all tissues and body fluids. Metabolism occurs in the liver. These drugs are potent inducers of hepatic microsomal enzymes.

Barbiturates have a narrow therapeutic index, and may cause apnea at sedative doses. The clinician should be prepared to manage the patient's airway and support respiratory function with mechanical ventilation. In general, other sedatives are preferred for procedure-related sedation.

Potential adverse reactions include:

- respiratory depression (dose-dependent)
- hypotension
- CNS alteration (prolonged sedation, paradoxical restlessness, and agitation)
- enhanced depressant effect when combined with other CNS depressants
- acute intermittent porphyria
- nausea, vomiting
- drug interactions-induces metabolism of warfarin, phenytoin, phenylbutazone, prednisone, hydrocortisone, and digoxin. Valproic acid and chloramphenicol inhibit phenobarbital metabolism.

Contraindications include:

- hypersensitivity to barbiturates
- porphyria
- severe hepatic dysfunction
- severe pulmonary disease

Phenobarbital (Barbita, Luminal)

Route	Onset	Dose	Duration
Intravenous (IV)	minutes	1-2 mg/kg	4-10 hr
Intramuscular (IM)	minutes	1-2 mg/kg	4-10 hr
Oral (PO)	hours	1-2 mg/kg	6-12 hr

Pentobarbital (Nembutal)

Route	Onset	Dose	Duration
IV	1 min	2-3 mg/kg (titrate additional 1-2 mg/kg prn)	30+ min
IM	10-20 min	2-6 mg/kg (max 100 mg)	1-4 hr
PO/Rectal (PR)	15-60 min	<4 years-3-6 mg/kg; >4 years-1.5-3 mg/kg (max 100 mg)	1-4 hr

Thiopental (Pentathol)

Route	Onset	Dose	Duration
IV	1 min	0.5-2.0 mg/kg (titrate to effect)	2-10 min

Methohexital (Brevital)

Route	Onset	Dose	Duration
IV	1 min	1.0-2.0 mg/kg (titrate to effect)	5-6 min
PR	10-30 min	15-30 mg/kg	1-3 hr

2. **Chloral Hydrate**-metabolized in the liver to trichloroethanol, the active metabolite (half-life, 4 to 14 hours), and excreted in the urine. Potential adverse reactions are prominent at repetitive and higher doses, and include:

- respiratory depression (especially at higher doses)
- cardiac dysrhythmias and depression
- nausea, vomiting, diarrhea
- paradoxical agitation, incoherence, hallucinations, prolonged sedation

Contraindications include:

- patients with upper airway obstruction
- patients with severe cardiac, hepatic, or renal disease
- premature infants or sick neonates

Route	Onset	Dose	Duration
PO/PR	30-60 min	<u>Pediatric:</u> 50-100 mg/kg (max 1-2 grams) <u>Adult:</u> 500-1000 mg	4-8 hr

3. **Benzodiazepines**-modulate GABA, a major inhibitory neurotransmitter in the CNS. They produce sedation, amnesia, anxiolysis, and have anticonvulsive effects but are devoid of analgesic properties. They are metabolized by the liver and excreted via the kidneys. In general, the short acting benzodiazepines are preferred. Potential adverse reactions include:

- respiratory depression (especially via IV route), reversible with flumazenil
- CNS alterations (excess sedation, paradoxical excitability, agitation)
- hypotension
- enhanced adverse reactions when used with other depressants (adjust dosage when combined with opioids)

Contraindications include:

- hypersensitivity to any benzodiazepine
- existing CNS depression
- patients with glaucoma

Midazolam (Versed)

Key Points: short-acting, produces anterograde amnesia

Route	Onset	Dose	Duration
IV	1-2 min	<u>Pediatrics:</u> <6 months-small increments advised (0.01-0.02 mg/kg) 6 months-5 years-initial dose 0.05-0.1 mg/kg. Total dose-up to 0.6 mg/kg, usually does not exceed 6 mg. 6-12 years-initial dose 0.025-0.05 mg/kg. Total dose-up to 0.4 mg/kg, usually does not exceed 10 mg. <u>Adult:</u> 0.05-0.1 mg/kg (titrate to effect)	1-2 hr
IM	5-15 min	<u>Pediatrics:</u> 0.1-0.15 mg/kg are usually effective. For more anxious patients, doses up to 0.5 mg/kg have been used. Total dose does not usually exceed 10 mg. <u>Adult:</u> 0.05-0.1 mg/kg	1-6 hr
Intranasal	8-12 min	0.3-0.7 mg/kg (max 15 mg)	30-45 min
PO/PR	15-20 min	0.2-0.5 mg/kg	30-45 min

Lorazepam (Ativan)

Key Points: intermediate acting, produces anterograde amnesia

Route	Onset	Dose	Duration
IV	1-2 min	0.05 mg/kg (titrate to effect)	6-8 hr
IM	5-15 min	0.05 mg/kg	10-20 hr
PO	15-20 min	0.05 mg/kg	10-20 hr

Diazepam (Valium)

Key Points: long acting, active metabolite (desmethyldiazepam) may cause return to drowsiness 6-8 hr after administration

Route	Onset	Dose	Duration
IV	1-4 min	0.1-0.2 mg/kg (administer slowly)	2-4 hr
PO	20-60 min	0.2-0.3 mg/kg	45 min-2 hr

4. **α_2 -agonists**-dexmedetomidine is the only commercially available α_2 -agonist that is indicated for sedation. Its primary indication is in the intensive care unit for mechanically ventilated patients, and accordingly it is not expected that it will be broadly utilized for procedure related sedation. Dexmedetomidine, as a single agent, will produce sedation, pain relief, anxiety reduction, stable respiratory rates, and predictable cardiovascular responses. Dexmedetomidine facilitates patient comfort, compliance and comprehension by offering sedation with the ability to rouse patients. Adverse reactions include:

- hypotension, hypertension, bradycardia, tachycardia, arrhythmias
- nausea, vomiting, thirst
- oliguria
- anemia, leukocytosis.
- hypoxia, pleural effusion, pulmonary edema.
- pain, infection

Contraindications include (use cautiously):

- advanced heart block
- renal impairment
- hepatic impairment
- elderly patients

Dexmedetomidine (Precedex)

Key Points: short-acting, analgesic

Route	Onset	Dose	Duration
IV	1-2 min	<u>Loading Dose:</u> 1 mcg/kg over 10 minutes <u>Maintenance:</u> 0.2-0.7 mcg/kg/hr (titrate to effect)	2-3 hr

Non-Opiate Analgesics

Ketorolac (Toradol)

Ketorolac is a nonsteroidal anti-inflammatory drug (NSAID) that exhibits analgesic, anti-inflammatory, and antipyretic activity. Clinical studies suggest that ketorolac 30 or 90 mg intramuscularly provides pain relief comparable to meperidine 100 mg or morphine 12 mg. Ketorolac 10 mg was comparable to 50 mg of meperidine or 6 mg of morphine.

Ketorolac inhibits platelet aggregation and may prolong bleeding time. The safety and efficacy of ketorolac in children has not been established. Potential adverse reactions include:

- gastrointestinal discomfort, bleeding
- abnormal hemostasis
- impaired renal function
- edema, hypertension

Contraindications include:

- hypersensitivity to ketorolac
- individuals with the syndrome of nasal polyps, angioedema, bronchospastic reactivity or other allergic manifestations to aspirin or other NSAIDs
- patients with a history of gastrointestinal ulcerations, bleeding or perforation
- pre-existing renal pathology
- impaired hepatic function
- heart failure
- hypovolemia
- patients for major surgery or who are anticoagulated

Route	Onset	Dose	Duration
IV	5 min	30-60 mg loading dose and half this dose every 6 hr. The lower end of this dose is suggested if <50 kg or >65 years of age.	4-6 hr
IM	5-10 min	30-60 mg loading dose and half this dose every 6 hr. The lower end of this dose is suggested if <50 kg or >65 years of age.	4-6 hr
PO	20-40 min	10 mg	4-6 hr

Opiate Analgesics

This class of drugs act as agonists at stereospecific opioid receptors throughout the CNS, altering the perception to painful stimuli. Effects include analgesia, sedation, alteration in mood, dose-related depression of respiration, and miosis. All of the opioids are metabolized in the liver and excreted in the urine. Potential adverse reactions include (use with caution in patients with respiratory depression, hepatic or renal dysfunction, or increased intracranial pressure):

- respiratory depression, apnea (especially with rapid IV administration—reversible with Narcan)
- hypotension, bradycardia
- CNS alterations (dizziness, confusion, euphoria, sedation, agitation, lethargy, dysphoria)
- nausea/vomiting/constipation
- pruritis
- urinary retention
- enhanced adverse reactions when used with other narcotics or benzodiazepines

Contraindications include:

- hypersensitivity to the specific opioid

Morphine

Key points: may cause histamine release with subsequent bronchospasm, urticaria, hypotension, or rarely anaphylaxis. Avoid use in patients with severe atopy or asthma.

Route	Onset	Dose	Duration
IV	5-10 min; peak 15-20 min	0.1-0.2 mg/kg (titrate to effect)	2-4 hr
IM/Subcutaneous (SQ)	15-40 min	0.1-0.2 mg/kg	2-4 hr

Fentanyl (Sublimaze)

Key Points: 100 times more potent than morphine, shorter duration of action than morphine, respiratory depression may last longer than analgesia, associated with chest wall rigidity (usually at higher doses when given rapidly IV)

Route	Onset	Dose	Duration
IV	1-2 min	<u>Adult:</u> 50-100 mcg; <u>Pediatric:</u> 1-3 mcg/kg (start with 1 mcg/kg, then 0.5 mcg/kg every 5 min)	30-90 min
IM	7-15 min	<u>Adult:</u> 50-100 mcg; <u>Pediatric:</u> 1-3 mcg/kg (start with 1 mcg/kg, then 0.5 mcg/kg every 5 min)	1-2 hr
PO	5-15 min	5-15 mcg/kg (maximum 400 mcg oralet)	60-90 min

Alfentanil (Alfenta)

Key points: short-acting opioid 1/5th to 1/10th as potent as fentanyl, associated with chest wall rigidity

Route	Onset	Dose	Duration
IV	1-2 min	5-25 mcg/kg----6 months-3 yr (titrate) 10-15 mcg/kg--->4 years (titrate)	15-30 min

Meperidine (Demerol)

Key points: 1/7.5 as potent as morphine, has a local anesthetic effect, may cause tachycardia, metabolite (normeperidine) is elliptogenic---may accumulate in patients with renal failure, contraindicated in patients receiving MAO inhibitors

Route	Onset	Dose	Duration
IV	5-10 min	1-1.5 mg/kg (slowly titrate to effect)	2-3 hr
SQ	40-60 min	1-2 mg/kg	2-4 hr
IM	20-40 min	0.5-2 mg/kg	2-3 hr

Methadone (Dolophine)

Key Points: similar in potency to morphine with a longer duration of action than morphine, high oral bioavailability

Route	Onset	Dose	Duration
IV	1-2 min	0.1-0.2 mg/kg (titrate to effect)	6-8 hr
PO	30-60 min	0.1-0.2 mg/kg	6-8 hr

Other

Ketamine (Ketalar)

Ketamine is a phencyclidine derivative that produces a dissociative state characterized by a cataleptic condition in which the eyes remain open with a slow nystagmic gaze. The patient is noncommunicative with varying degrees of hypertonus and purposeful movement that often occur independent of surgical stimulation. The patient is amnestic, and analgesia is intense. The possibility of emergence delirium limits the clinical usefulness of ketamine in adults. Ketamine is demethylated to form norketamine that is one fifth to one third as potent as ketamine and may contribute to the prolonged effects of ketamine. Inclusion of an antisialagogue is recommended to avoid coughing and laryngospasm owing to ketamine-induced salivary secretions. Intense analgesia can be achieved with subanesthetic doses of ketamine, 0.2 to 0.5 mg/kg IV.

Unconsciousness is usually associated with maintenance of normal pharyngeal and laryngeal reflexes. Return of consciousness usually occurs in 10 to 15 minutes following an intravenous dose of ketamine, but complete recovery is delayed.

Because of its rapid onset of action, ketamine has been used as an intramuscular sedative drug in children. Ketamine has been used extensively for dressing changes. The administration of ketamine to patients with coronary artery disease has been questioned because of increased myocardial oxygen requirements that may accompany this drug's sympathomimetic effects on the heart. Ketamine should be used cautiously or avoided in patients with systemic or pulmonary hypertension or increased intracranial pressure. Critically ill patients occasionally respond to ketamine with unexpected decreases in blood pressure and cardiac output. This may reflect depletion of catecholamine stores and exhaustion of sympathetic nervous system compensating mechanisms, leading to an unmasking of ketamine's direct myocardial-depressant effects.

Ketamine does not produce significant depression of ventilation. Airway malalignment can occur. Moreover, apnea can occur if the drug is administered rapidly intravenously or an opioid is included in the preoperative medication.

Emergence from ketamine may be associated with visual, auditory, proprioceptive, and confusional illusions, which may progress to delirium. Cortical blindness may be transiently present. Dreams and hallucinations can occur up to 24 hours after administration of ketamine. Dreams and hallucinations usually disappear within a few hours. The incidence of emergence delirium following ketamine ranges from 5-30%. Factors associated with an increased incidence of emergence delirium include: 1) age greater than 16 years; 2) female sex; 3) doses of ketamine greater than 2 mg/kg IV; and 4) a history of personality problems or frequent dreaming.

Benzodiazepines have proven effective in the prevention of emergence delirium, with midazolam being more effective than diazepam. A common approach is to administer the benzodiazepine intravenously about 5 minutes prior to induction of anesthesia with ketamine. The inclusion of atropine or droperidol in the preoperative medication may increase the incidence of emergence delirium. Potential adverse reactions include:

- airway malpositioning
- salivation
- tachycardia
- systemic and pulmonary hypertension
- increased intracranial pressure
- emergence delirium

Contraindications include:

- age <3 months (use with caution if patient 3-12 months of age)
- high risk or difficult airway
- procedures that stimulate the posterior pharynx
- active respiratory infection or disease
- cardiovascular disease including angina, heart failure, or hypertension
- intracranial injury with the likelihood of intracranial hypertension
- intracranial hypertension
- poorly controlled seizure disorder
- glaucoma or acute globe injury
- psychiatric disorders
- porphyria
- thyroid disorder

Route	Onset	Dose	Duration
IV	1 min	1.0-1.5 mg/kg (titrate to effect)	1-2 hr
IM	5 min	2-5 mg/kg	1-2 hr

Nitrous Oxide

Nitrous oxide has a narrow therapeutic index, and may cause apnea at sedative doses. The clinician should be prepared to manage the patient's airway and support respiratory function with mechanical ventilation. In general, other sedatives are preferred for procedure-related sedation.

Nitrous oxide is a gaseous agent with both analgesic and anesthetic properties. The MAC (dose required to keep 50% of patients nonresponsive to surgical stimuli) is 105%. Diffusion hypoxia can occur in the early period of nitrous oxide elimination as a great amount of nitrous oxide transfers from the body into the lungs. This is prevented by administering oxygen.

Nitrous oxide is 34 times more soluble than nitrogen. Accordingly, nitrous oxide will expand closed cavities (i.e., nitrous oxide moves in fast, while nitrogen slowly escapes), and is contraindicated in patients with tension pneumothorax, air embolus, pneumocephalus, and other situations in which the expansion of closed air spaces in the body would be hazardous.

Cardiovascular Function	Effect of Nitrous Oxide
Blood Pressure	Variable
Cardiac Output	Depressed
CNS Function	
Intracranial Pressure	Increased
Respiratory Function	
PaCO ₂	Unchanged
Response to CO ₂	Depressed
Response to Hypoxia	Depressed

Methionine synthase activity is decreased by about 50% after exposure to clinical doses of nitrous oxide. Taking all the data into account on the effect of nitrous oxide on folate and vitamin B₁₂ metabolism, it appears that the use of nitrous oxide for limited periods of time in patients that are not high risk to develop vitamin B₁₂ deficiency is appropriate; and that an occasional high-risk patient may develop signs of vitamin B₁₂ deficiency after even a short exposure of nitrous oxide.

Propofol (Diprivan)

Propofol has a narrow therapeutic index, and may cause apnea at sedative doses. The clinician should be prepared to manage the patient’s airway and support respiratory function with mechanical ventilation. In general, other sedatives are preferred for procedure-related sedation.

Propofol is an agent with rapid onset and prompt recovery. It is used for general anesthesia or deep sedation. The elimination half-time is 0.5-1.5 hours. Despite the rapid clearance of propofol by hepatic metabolism, there is no evidence of impaired elimination in patients with cirrhosis. Renal dysfunction does not influence the clearance of propofol. Patients >60 years of age exhibit a reduced rate of plasma clearance of propofol. Potential adverse reactions include:

- hypotension (hypovolemic or elderly patients, or patients with decreased ventricular function)
- bradycardia
- apnea (especially when given with opioids)
- pain at the site of injection
- fever (related to lack of aseptic technique in handling the drug)

Contraindications include:

- hypovolemic patients
- intralipid allergy
- compromised left ventricular function

Route	Onset	Dose	Duration
IV	1 min	Initially 100-150 mcg/kg/min for 3 to 5 min. Thereafter 25-75 mcg/kg/min	2-10 min

DPT Cocktail (Demerol, Phenergan, Thorazine)

DPT has a narrow therapeutic index, and may cause apnea at sedative doses. The clinician should be prepared to manage the patient’s airway and support respiratory function with mechanical ventilation. In general, other sedatives are preferred for procedure-related sedation.

The DPT cocktail is an older form of intramuscular sedation which is primarily indicated for children. Although most children would rather not receive a needlestick, this technique can be useful in children over one year of age. This cocktail typically consists of meperidine (Demerol, 2 mg/kg), promethazine (Phenergan, 1 mg/kg), and chlorpromazine (Thorazine, 1 mg/kg). With many contemporary alternatives available, this cocktail is not recommended by the American Academy of Pediatrics because of its narrow therapeutic index, i.e., significant potential for prolonged sedation and respiratory depression. It is not available at *Loma Linda University Medical Center & Children's Hospital* in the combined preparation.

Promethazine and chlorpromazine are very long-acting drugs and produce profound sedation and analgesia at the time of the procedure, and sedation and respiratory depression for several hours afterwards. Chlorpromazine can induce seizures in those with an underlying seizure focus.

Diphenhydramine (Benadryl)

An antihistamine commonly prescribed for its sedative effects prior to procedures, children may display a paradoxical excitability with diphenhydramine. Potential adverse reactions include:

- excitement
- dry mouth
- urinary retention

Contraindications include:

- hypersensitivity to the drug

Route	Onset	Dose	Duration
IV	3-5 min	Adult: 25-100 mg; Pediatric: 1 mg/kg	4-8 hr
PO	1-2 hr	Adult: 25-100 mg; Pediatric: 1 mg/kg	4-8 hr

Reversal Agents

Naloxone (Narcan)

Naloxone is an opioid antagonist that reverses opiate-induced CNS and respiratory depression. Naloxone may be administered IV, IM, SQ, and down an endotracheal tube. Naloxone has a shorter half-life than most of the narcotics (doses may have to be repeated). Naloxone will also promptly reverse opioid-induced analgesia, and produce withdrawal phenomenon. Naloxone is metabolized in the liver and excreted in the urine. Potential adverse reactions include:

- reversal of analgesia/opioid withdrawal
- nausea/vomiting
- hypertension/tachycardia

- pulmonary edema, cardiac dysrhythmias

Contraindications include:

- hypersensitivity to naloxone
- history of opioid dependence

Route	Onset	Dose	Duration
IV	1-2 min	0.01 mg/kg/dose (max 2 mg); repeat every 2-3 min as needed	20-60 min
IM/SQ/Tracheal	2-5 min	0.01 mg/kg/dose (max 2 mg); repeat every 2-3 min as needed	20-60 min

Flumazenil (Romazicon)

Flumazenil is a benzodiazepine receptor antagonist that reverses the sedative effects, psychomotor impairment, and possibly amnestic response caused by benzodiazepines. Flumazenil also has a shorter half-life than some of the benzodiazepines (e.g. Valium, Ativan) therefore, doses may have to be repeated. Flumazenil is metabolized primarily in the liver and excreted in the urine. Potential adverse reactions include:

- sweating, flushing, hot flashes
- nausea, vomiting, hiccups
- CNS agitation, abnormal vision, paresthesias
- seizures (especially in patients on chronic benzodiazepine therapy)
- precipitation of benzodiazepine withdrawal symptoms

Contraindications include:

- hypersensitivity to benzodiazepines or flumazenil
- patients on chronic benzodiazepine therapy
- patients with seizure disorders

Route	Onset	Dose	Duration
IV	1-5 min	<u><12 years:</u> 0.01 mg/kg (max 0.2 mg/dose); repeat at 1 min intervals as needed, up to a total dose of 1 mg <u>>12 years:</u> 0.2 mg/dose; repeat at 1 min intervals as needed, up to a total dose of 1 mg	20-60 min

Drug Dosing Guidelines for Procedure Related Sedation and Analgesia: alterations in dosing may be indicated based on the clinical situation and the practitioner's clinical experience with these agents. Individual agent dosages may vary when used in combination with other agents, especially when benzodiazepines are combined with narcotics. RD-respiratory depression.

Medication	Adult Dose	Pediatric Dose	Onset (min)	Duration (hr)	Adverse Reactions	Warnings*
Sedatives						
Phenobarbital	1-2 mg/kg	1-2 mg/kg	IV: 5-10. IM: minutes. PO: hours	IV: 4-10. IM: 4-10. PO: 6-12	RD, hypotension, drug interactions	avoid in patients with porphyria
Pentobarbital (<i>Nembutal</i>)	IV: 2-3 mg/kg IM: 2-6 mg/kg	IV: 1-3 mg/kg, max 100mg PO/PR: 2-6 mg/kg, max 100 mg	IV: 1-2. IM: 10-15. PO/PR: 15-60	IV: 30+ min. IM: 1-4. PO/PR: 1-4	RD, hypotension, drug interactions	avoid in patients with porphyria
Thiopental (<i>Pentothal</i>)	IV: 0.5-2 mg/kg	IV: 0.5-2 mg/kg	IV: 1	2-10 min	RD, hypotension, drug interactions	avoid in patients with porphyria
Methohexital (<i>Brevital</i>)	IV: 1-2 mg/kg	IV: 1-2 mg/kg PR: 15-30 mg/kg	IV: 1 PR: 10-30	IV: 5-6 min PR: 1-3	RD, hypotension, drug interactions	avoid in patients with porphyria
Chloral Hydrate	PO: 500-1000 mg	PO/PR: 50-100 mg/kg (max 2 g)	30-60	4-8	RD	---
Midazolam (<i>Versed</i>)	IV: 0.05-0.1 mg/kg IM: 0.05-0.1 mg/kg	IV: <6 mn 0.01-0.02 mg/kg; 6 mn-5yr 0.05-0.1 mg/kg; 6-12 yr 0.025-0.05 mg/kg. IM: 0.1-0.15 mg/kg. Nasal: 0.3-0.7 mg/kg. PO/PR: 0.2-0.5 mg/kg	IV: 1-2 IM: 5-15 Nasal: 8-12 PO/PR: 15-20	IV: 1-2 IM: 1-6 Nasal/PO/PR: 30-45 min	RD	---
Lorazepam (<i>Ativan</i>)	IV/IM: 0.02-0.05 mg/kg PO: 0.02-0.05 mg/kg	IV/IM: 0.02-0.05 mg/kg PO: 0.02-0.05 mg/kg	IV: 1-2. IM: 5-15. PO: 15-20	IV: 6-8. IM: 10-20. PO: 10-20	RD	---
Diazepam (<i>Valium</i>)	IV: 0.1-0.2 mg/kg PO: 0.2-0.3 mg/kg	IV: 0.1-0.2 mg/kg PO: 0.2-0.3 mg/kg	IV: 1-4 PO: 20-60	IV: 2-4 PO: 1-2	RD	---
Non-opiate Analgesics						
Ketorolac (<i>Toradol</i>)	IV/IM: 30-60 mg load, load q 6 hr; PO: 10 mg	not recommended	IV: 5; IM: 5-10 PO: 20-40	IV: 4-6; IM: 4-6 PO: 4-6	abnormal hemostasis, GI discomfort	avoid in hypovolemic patients
Opiate Analgesics						
Morphine	IV: 0.1-0.2 mg/kg IM/SQ: 0.1-0.2 mg/kg	IV: 0.1-0.2 mg/kg IM/SQ: 0.1-0.2 mg/kg	IV: 5-10 IM/SQ: 15-40	IV: 2-4 IM/SQ: 2-4	RD	enhanced effect with sedatives
Fentanyl (<i>Sublimaze</i>)	IV/IM: 50-100 mcg	IV: 1 mcg/kg, then 0.5 mcg/kg q 5 min PO: 5-15 mcg/kg	IV: 1-2. IM: 7-15. PO: 5-15	IV: 30-90 min. IM: 1-2 PO: 60-90 min	RD, chest rigidity	enhanced effect with sedatives
Alfentanil (<i>Alfenta</i>)	IV: 10-15 mcg/kg	IV: 5-25 mcg/kg	IV: 1-2	IV: 15-30 min	RD, chest rigidity	enhanced effect with sedatives
Meperidine (<i>Demerol</i>)	IV: 1-1.5 mg/kg SQ: 1-2 mg/kg IM: 0.5-2 mg/kg	IV: 0.5 mg/kg SQ: 0.5 mg/kg IM: 0.5 mg/kg	IV: 5-10 SQ: 40-60 IM: 20-40	IV: 2-3 SQ: 2-4 IM: 2-3	RD, elliptogenic metabolite	enhanced effect with sedatives, do not give to patients on MAOs
Methadone (<i>Dolophine</i>)	IV: 0.1-0.2 mg/kg PO: 0.1-0.2 mg/kg	IV: 0.1 mg/kg PO: 0.1 mg/kg	IV: 1-2 PO: 30-60	IV: 6-8 PO: 6-8	RD	enhanced effect with sedatives
Other						
Ketamine (<i>Ketalar</i>)	not recommended	IV: 1.0-1.5 mg/kg IM: 2-5 mg/kg	IV: 1 IM: 5	IV: 1-2 IM: 1-2	emergence delirium, tachycardia, salivation	---
Nitrous Oxide	20-50%	20-50%	immediate	3-5 min	inhibits methionine synthase	avoid in patients with closed air spaces
Propofol (<i>Diprivan</i>)	IV: 100-150 mcg/kg/min load, followed by 25-75 mcg/kg/min	IV: 100-150 mcg/kg/min load, followed by 25-75 mcg/kg/min	IV: 1	IV: 2-10 min	pain at injection site	intralipid allergy
Diphenhydramine (<i>Benadryl</i>)	IV: 25-100 mg PO: 25-100 mg	IV: 1 mg/kg PO: 1 mg/kg	IV: 3-5 PO: 1-2 hr	IV: 4-8 hr PO: 4-8 hr	dry mouth, urinary retention	---
Reversal Agents						
Naloxone (<i>Narcan</i>)	IV/IM/SQ/trach: 0.01 mg/kg, q 2 min (max 2 mg)	IV/IM/SQ/tracheal: 0.01 mg/kg, q 2 min (max 2 mg)	IV: 1-2 IM/SQ/trach: 2-5	IV: 20-60 min IM/SQ/trach: 20-60 min	pulmonary edema, opioid withdrawal	---
Flumazenil (<i>Romazicon</i>)	IV: 0.2 mg q 1 min (max 1 mg)	IV: 0.1 mg/kg (max 0.2 mg) q 1 min (max 1 mg)	IV: 1-5	IV: 20-60 min	benzodiazepine withdrawal	avoid in patients on benzodiazepines

*When administering sedative/analgesic agents to the geriatric patient—START LOW, AND GO SLOW—this permits titration of the agent to the minimal dose required for optimal clinical effect.

REVIEW OF AIRWAY MANAGEMENT AND HOW TO CARE FOR THE PATIENT WITH A DIFFICULT AIRWAY

Objectives:

1. To review the basic techniques for airway assessment.
2. To review the basic techniques for maintaining a patent airway in patients with airway malalignment.
3. To review techniques for determining which patients might present with difficult airway management.

Airway management involves more than proficiency with tracheal intubation techniques. The clinician must understand the physiologic consequences and complications of endotracheal intubation and have knowledge of the anatomy, pathologic conditions of the airway, and methods of assessment. This section will serve as a review of these principals.

Anatomy: Located at C₄₋₆, the larynx is composed of cartilage, ligaments, and muscle. It is lined by mucous membrane, which is continuous with that of the pharynx and trachea. The laryngeal cavity extends from the laryngeal inlet to the caudal border of the cricoid cartilage. The larynx is bounded anteriorly by the epiglottis, posteriorly by the mucous membrane that extends between the arytenoid cartilages, and laterally by the aryepiglottic folds. The vocal cords extend from the thyroid cartilage to the arytenoid cartilages. The glottis is the triangular opening between the vocal cords. The portion of the laryngeal cavity above the vocal cords is the vestibule. In the adult, the area between the vocal cords is the narrowest part of the laryngeal cavity. The larynx primarily protects the lower airway by preventing foreign matter from entering it.

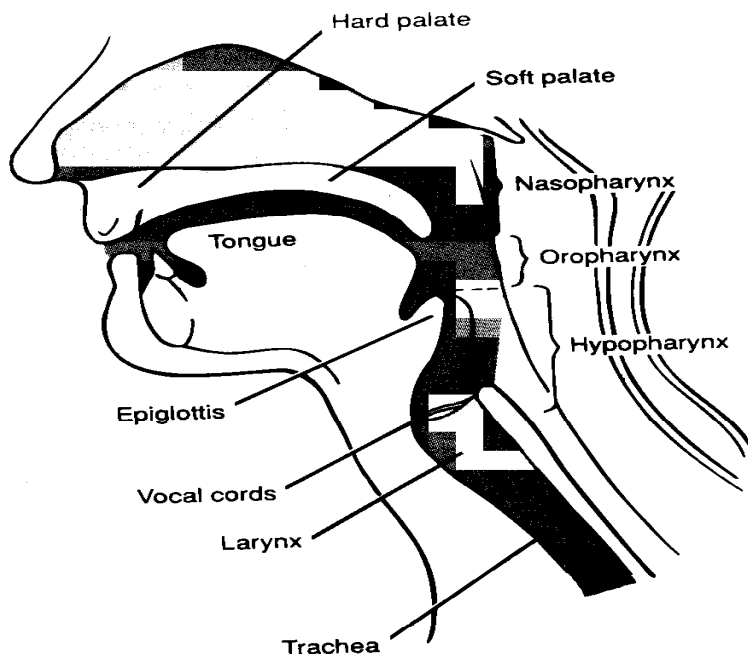


Figure 1: Airway anatomy.

Airway Assessment: The patient should be questioned about symptoms suggestive of airway abnormalities, such as shortness of breath or hoarseness. Hoarseness in patients with rheumatoid arthritis may indicate involvement of the cricoarytenoid cartilages and narrowing of the laryngeal opening. Information should also be sought regarding previous surgery, trauma, or neoplasia involving the airway and prior anesthetic experiences. Whenever possible, previous anesthesia records should be reviewed.

The head should be viewed in profile so that a small or receding jaw, a feature associated with difficult laryngoscopy and intubation, can be detected. The presence of protruding teeth, also best appreciated from the lateral aspect, may complicate endotracheal intubation. Conversely, it can be difficult to secure a tight seal with a face mask in edentulous patients. Loose, capped, and prosthetic teeth should be noted. Nonfixed dental prostheses should be removed before sedation. A cleft or long, high-arched palate is often associated with difficult tracheal intubation.

The ease of tracheal intubation can be predicted by having the seated patient open his or her mouth and protrude the tongue maximally. When the faucial pillars, soft palate, and uvula are easily visualized, laryngoscopy should be easy. Laryngoscopy may be easy or difficult if only the faucial pillars and soft palate are visible but the uvula is obscured by the tongue. When only the soft palate is visualized, exposure of the glottis is almost invariably difficult (see Figure 2).

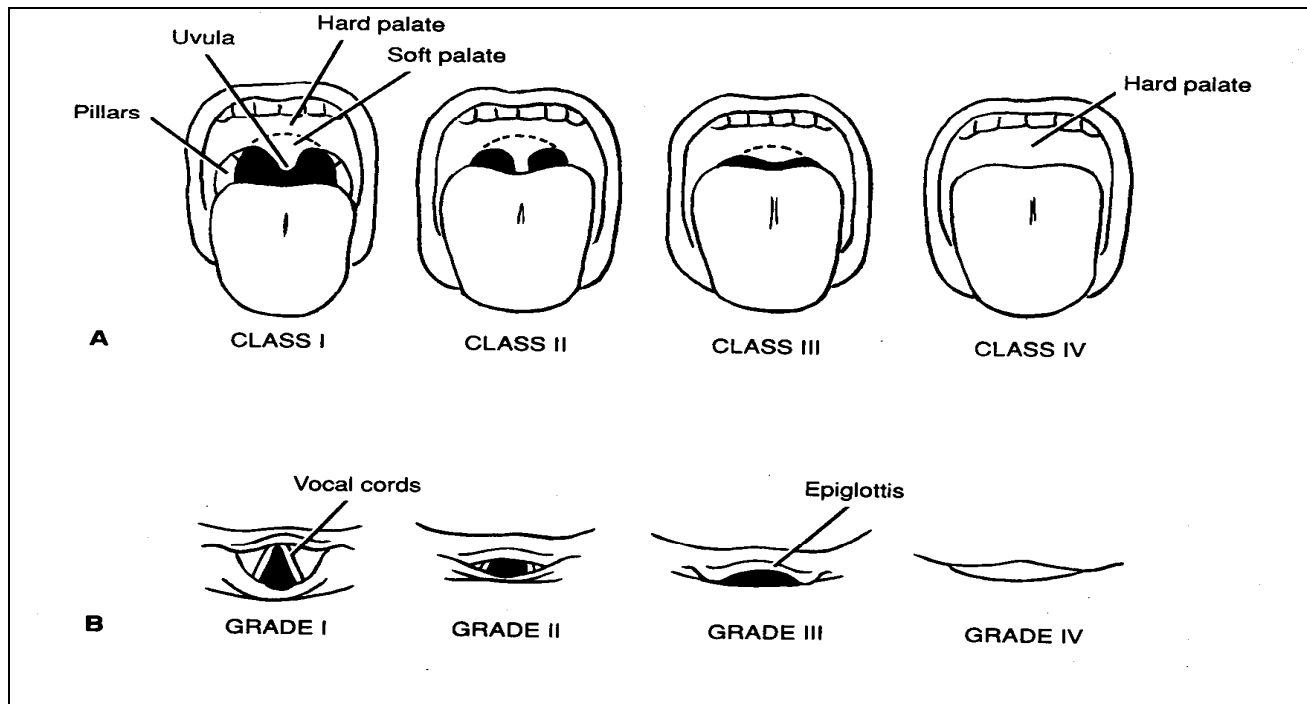


Figure 2: A difficult orotracheal intubation (grade III or IV) may be predicted by the inability to visualize certain pharyngeal structures (class III or IV) during examination of the seated patient.

Temporomandibular joint mobility is assessed by asking the patient to open the mouth. In the adult, the distance between the upper and lower central incisors is normally 4-6 cm. Ankylosis of the temporomandibular joints is seen most frequently in patients with rheumatoid arthritis. However, it is also prevalent in patients with Type I diabetes mellitus. In trauma patients or those who have an infection involving the mouth or neck, mobility may be restricted by pain.

Cervical spine mobility must be evaluated as intubation usually involves neck extension. It is best to have the patient sit or stand during this examination, since the degree of restricted movement will be obscured if the patient's head is on a pillow. The normal range of flexion-extension of the neck varies from 90-165°. Patients with rheumatoid arthritis, ankylosing spondylitis, or diabetes mellitus may have decreased cervical spine mobility. Any type of movement that produces paresthesias or sensory or motor deficits must be noted and avoided.

The probability of tracheal intubation also can be assessed by measurement of the distance, normally >6.5 in adults, between the lower border of the mandible and the thyroid notch when the patient's neck is fully extended. If the measurement is less than 6 cm, it may be difficult to visualize the larynx. If the distance is 6.5 cm and the patient has prominent teeth, a thick neck, or decreased neck mobility, difficulty in visualizing the larynx should be anticipated. The neck should be palpated to detect masses and tracheal deviation. The five risk factors that are most consistently associated with a difficult airway are obesity, decreased head and neck movement, receding mandible, reduced jaw movement, and buck teeth. In the event a difficult airway is anticipated, consultation with an anesthesiologist should be considered.

Airway Obstruction: The most frequent site for airway obstruction is the oropharynx. With sedation, there is relaxation of the jaw and tongue such that the base of the tongue may fall back in contact with the posterior pharynx. To relieve this obstruction, the clinician should place his or her hands behind the angle of the patient's mandible and move it forward. Care must be taken to avoid putting pressure on the anterior structures of the neck, which can accentuate the obstruction. Other measures useful in opening the upper airway include slight extension of the neck, turning the head to the side, application of positive airway pressure to "distend" the soft tissue, and insertion of an oral or nasal airway. The oropharynx should be examined to ensure that the obstruction is not from a foreign body. Airway obstruction can also be caused by reflex closure of the vocal cords, a condition known as laryngospasm. This typically occurs during sedation when the larynx is irritated by contact with secretions, or when the patient experiences a painful stimulus. Partial laryngospasm is characterized by high-pitched phonation or "crowing." Total occlusion is characterized by no sounds but signs of airway obstruction such

as retraction of the trachea or flaring of the nostrils. Depending on the cause, treatment should include suctioning foreign material from the oropharynx, removing any painful stimulus, administering 100% oxygen, applying positive pressure to the airway, and placing the fingers behind the angles of the mandible to thrust the jaw forward. If these measures do not resolve the laryngospasm quickly, a rapidly acting muscle relaxant may be indicated.

Ventilatory Support: The ability to assist with respirations with a bag-valve device and mask is a valuable skill for those providing procedure-related sedation. The use of the bag-valve device and mask has several advantages: it provides an immediate means of ventilatory support; conveys a sense of compliance of the patient's lungs to the rescuer; can be used with spontaneously breathing patients; and can deliver an oxygen-enriched mixture to the patient.

Typically, the bag-valve device is available in three sizes: adult (capable of storing between 1000-1600 ml of gas), child (500-700 ml of gas), and infant (150-240 ml of gas). Standardized adult and pediatric bag-valve devices provide equally effective ventilation in infant mannequin lung models. Also, the use of larger resuscitation bags do not result in excessive ventilation.

Small-volume (infant), self-inflating bag devices do not deliver an adequate tidal volume to the infant with poorly compliant lungs. The small bag volumes also limit the duration of inspiration, which needs to be prolonged when the lungs are atelectatic. Thus, child-size and adult-size self-inflating bags may be used for the entire range of infants and children.

While its use has gained widespread acceptance in all care settings, the bag-valve-mask device has also been characterized as cumbersome and difficult to use. The most frequent problem with the bag-valve-mask device is the inability to provide adequate ventilatory volumes to a patient who is not endotracheally intubated. This most commonly results from the difficulty of providing a leak-proof seal to the face while maintaining an open airway. It also occurs when the bag is not squeezed sufficiently enough to force an adequate amount of air into the patient's lungs.

The following points are offered as a review of effective ventilation techniques:

1. While acceptable in some situations, a bag-valve mask device used in emergency situations should not contain a "pop-off" valve. The pressure required for ventilation in many situations may exceed the pop-off limit, and delivered tidal volume may be insufficient.
2. Mask fit is much more important than resuscitation bag size to ensure adequate ventilation.
3. The chin of the patient should be held forward in a sniffing position.

4. The most advantageous position for ventilation will be slightly different for each patient. Therefore, the head should be moved into various positions by flexion, extension, and lateral rotation until the best airway is obtained.
5. It may be helpful to insert an oral or nasal airway.
6. The mask used for assisted ventilation should be of an appropriate size for each patient. The upper end of the mask should fit over the bridge of the nose and be well below the eyes. The lower end should be on or directly above the mandible.
7. Place the finger of the left hand just under the mandible to support it in an anterior position (pull the face into the mask). Position the mandible with the left hand; place the mask on the bridge of the nose with the right hand, and encircle the mask with the thumb and forefinger of the left hand. Hold tightly. Do not apply pressure to the soft parts of the chin, or the tongue may be pushed into the posterior pharynx and obstruct the airway further. Apply pressure to the mask primarily with the thumb and forefinger of the left hand. Squeeze the ventilating bag with the right hand, using a smooth compression. Once ventilatory assistance is begun, continual assessment is necessary for determining whether an adequate amount of air is being delivered with the bag-valve device. Chest rise must be visualized with each delivered ventilation. If there is no chest movement, there is no ventilation.
8. To effectively use the bag-valve-mask device, the rescuer must be positioned at the top of the patient's head. Otherwise it may be impossible to maintain an effective seal between the mask and the patient's face and keep the airway open at the same time.
9. Leaks around the mask occur if the breathing bag collapses without inflating the patient's chest. To prevent leaking, change the mask position or size, or hold it more tightly in place. However, do not press down on the mask and force the mandible backward—this occludes the airway. To ensure ventilatory effectiveness, attention must be paid to the resistance in the bag with each delivered breath. A great deal of resistance (noted by a bag that is hard to squeeze) is indicative of upper or lower airway obstruction. The most likely culprit is a tongue that has fallen back against the oropharynx. To correct this problem, unless trauma is suspected, further hyperextend the patient's head by applying more backward pressure on the mandible with the two or three fingers of the right hand. If not already in place, insert an oropharyngeal airway if the patient lacks a gag reflex. Other possible causes include foreign body obstruction, tension pneumothorax, and severe bronchospasm. NOTE: A bag that compresses extremely easily is indicative of a leak somewhere in the bag system. The best indicator of effective ventilation is the rise and fall of the patient's chest.

10. If it is necessary to use both hands to hold the mandible forward and hold the mask on the face, a second person can squeeze the bag.
11. With each squeeze of the ventilating bag, the chest should expand and good breath sounds should be audible. The patient's color should improve, and if airway obstruction was present, breathing should become noticeably easier.
12. If the head is malpositioned, gastric distension will occur as the bag is squeezed. To correct this, the head should be repositioned. Gastric distention caused during artificial ventilation interferes with ventilation by elevating the diaphragm and decreasing lung volume. This occurs most often in children but is also seen in adults. The incidence of gastric distention is minimized by limiting ventilation volumes and pressures to those that raise the chest, thus avoiding exceeding the esophageal opening pressure. Manual ventilation should be performed with cricoid pressure (Sellick maneuver). The Sellick maneuver, or posterior displacement of the larynx, is produced with steady pressure on the cricoid cartilage. Appropriate application of cricoid pressure prevents gastric gas insufflation during airway management via mask up to 40 cm H₂O peak inspiratory pressure in infants and children. Gastric distention may have occurred due to previous aerophagia. Attempts at relieving gastric distention by pressure on the abdomen should be avoided because of the high risk of aspirating gastric contents into the lungs during this maneuver. If ventilation is totally ineffective because of gastric distention, then gastric decompression should be attempted. The patient's entire body is turned to the side before pressure is applied to the epigastrium or, preferably, a nasogastric tube is passed.
13. Take care to allow the patient to completely exhale after each delivered breath. Ventilatory assistance that is too rapid will lead to gas trapping. The ventilatory rate described above will give the patient sufficient time to passively exhale. There is no predetermined ventilatory rate.
14. If assisted ventilation is necessary for an extended period of time, or the bag-valve-mask system fails to adequately ventilate the patient, an endotracheal tube should be inserted. Good bag-valve-mask ventilation technique is mandatory to keep the patient alive while preparations are made for a safe and controlled endotracheal intubation. This is not a basic life support skill as much as an initial life support skill.

The Difficult Airway: The true incidence of difficulty with endotracheal intubation is unknown but has been estimated at 1-3%. In the majority of patients, the difficulty can be predicted. The degree of difficulty with intubation that can be expected has been classified on the basis of the

view obtained at laryngoscopy (see Figure 2). In situations where a difficult airway is anticipated, consultation with an anesthesiologist should be considered.

When the larynx cannot be visualized and an endotracheal tube cannot be placed, the clinician must consider the alternatives to airway management and formulate a plan based on the cause of the difficulty, the patient's condition, and the type and urgency of the clinical situation. If the patient can be ventilated by mask, mask ventilation can be continued while calling for help. In this situation, alternative techniques applied by those familiar with difficult airway management may prove effective. If the respiratory problems are due to narcotic/benzodiazepine agents, the effects of these drugs should be reversed with specific antagonists, e.g., naloxone, flumazenil.

SPECIFIC ISSUES IN THE PEDIATRIC PATIENT

Objectives:

1. To understand unique issues of concern in the pediatric patient for procedure-related sedation.

The pediatric patient refers to neonates (<30 days of age), infants (1-12 months of age), and children (1-14 years of age). The successful management of these patients depends on an appreciation of their physiologic, anatomic, and pharmacologic differences from adults. These changes are most profound in neonates and infants and are listed below. Two appendices (V & VI) are attached which provide additional information on airway management in pediatric patients.

Physiologic

- heart rate dependent cardiac output
- faster heart rate
- lower blood pressure
- faster respiratory rate
- lower lung compliance
- greater chest wall compliance
- lower functional residual capacity
- ↑ratio of body surface area to body weight
- higher total body water content

Anatomic (continued)

- large head and tongue
- narrow nasal passages
- anterior and cephalad larynx
- long epiglottis
- short trachea and neck
- prominent adenoids and tonsils
- weak intercostal and diaphragmatic muscles
- high resistance to airflow

Anatomic

- noncompliant left ventricle
- residual fetal circulation
- difficult venous cannulation

Pharmacologic

- immature hepatic biotransformation
- decreased protein binding
- variable response to sedative/analgesic agents
- ↑volume of distribution for water soluble drugs

Table 1-Key Points.

System	Key Point	Effect
HEENT	proportionately large head and tongue, narrow nasal passage, anterior and cephalad larynx, prominent occiput, long epiglottis, short trachea and neck	obligate nasal breathers, compression of submandibular soft tissue during mask ventilation, difficult airway (Table 2)
Cardiovascular	heart rate dependent cardiac output	bradycardia may rapidly progress to cardiac arrest
Pulmonary	↓function residual capacity with limited oxygen reserve; recent viral infection may place the patient at increased risk of pulmonary complications; history of apnea and a post-conceptual age <52 weeks	apnea or depressed ventilation is a major cause of morbidity and mortality apnea during the 12-24 hour period following sedation. Consider overnight hospitalization and observation for apnea.
Metabolic	susceptible to hypothermia susceptible to hypoglycemia	serious problem that is associated with delayed awakening, cardiac irritability, respiratory depression, increased vascular resistance, and altered drug responses consider revising NPO status
Pharmacologic	disproportionate size of the pediatric intravascular and extracellular fluid compartments, immaturity of hepatic biotransformation, increased organ blood flow, decreased protein binding, higher metabolism, decreased function of blood-brain barrier	variable response to sedation/analgesics

Table 2-Causes of Difficult Intubation.

<p>Anatomic Abnormalities</p> <ul style="list-style-type: none"> Short neck Receding mandible Narrowed mouth with high arched palate Limited movement of mandible Maxillary protrusion Mandibular hyperplasia Cervical rigidity Obesity <p>Congenital Abnormalities</p> <ul style="list-style-type: none"> Choanal atresia Encephalocele involving nasofrontal region Congenital fusion of the jaws Macroglossia Maxillofacial cleft Treacher-Collins syndrome (mandibulofacial dysostosis) Craniofacial dysostosis (Crouzon's syndrome) Klippel-Feil syndrome Achondroplasia (chondrodystrophia fetalis) Fetal alcohol syndrome Subglottic cysts Cystic hygroma Vascular compression of the trachea Subglottic stenosis Mucopolysaccharide disease Hurler's syndrome Hunter's syndrome Morquio's syndrome Laryngeal web Down's syndrome 	<p>Trauma</p> <ul style="list-style-type: none"> Facial injuries Mandibular fractures Maxillary fractures Laryngeal and tracheal trauma Hemorrhage into respiratory tract Recurrent laryngeal nerve damage Dislocation of arytenoid cartilages Tracheal rupture Cervical spine injury <p>Infectious Disease</p> <ul style="list-style-type: none"> Bacterial infection of gums, upper respiratory tract Retropharyngeal abscess Epiglottitis Diphtheria Croup Infectious Mononucleosis Tonsillitis <p>Inflammatory</p> <ul style="list-style-type: none"> Rheumatoid arthritis Instability of cervical spine Cervical fixation Temporomandibular disease Cricoarytenoid disorders Hypoplastic mandible Ankylosing spondylitis <p>Tumor Mass</p> <ul style="list-style-type: none"> Cystic hygroma Hemangioma
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When administering sedative/analgesic agents to the pediatric patient, TITRATE the sedative/analgesic agent to the minimal dose required for the optimal clinical effect.

SPECIFIC ISSUES IN THE GERIATRIC PATIENT

Objectives:

1. To understand unique issue of concern in geriatric patients for procedure-related sedation.

The geriatric patient most commonly refers to those >65 years. Aging changes are important in patients receiving sedation and include loss of overall physiologic reserve (cardiac, pulmonary, CNS, renal, and hepatic organ systems) and pharmacokinetic and pharmacodynamic changes. Multiple concomitant diseases are the rule, not the exception.

Table 1-Assessment Points.

System	Effect	History	Physical Exam	Tests
HEENT	inadequate mask fit, difficult laryngoscopy; laryngeal, pharyngeal, airway reflexes less effective in older patients	presence of dentures, history of difficult airway	dentition, range of motion of C-spine and temporomandibular joint, facial contour	
Cardiovascular	hypertension, LV hypertrophy, mild aortic dilation, ↓max heart rate, coronary artery disease, ↓cardiac reserve, ↓response to atropine and sympathomimetics	exercise tolerance, symptoms and history of coronary artery disease and congestive heart failure	heart murmur, S ₃	ECG, stress test or other cardiac evaluation as indicated
Pulmonary	↓vital capacity, lung capacity, breathing capacity; V/Q mismatch, ↓PaO ₂ , ↓response to hypoxia and hypercapnea	exercise tolerance		pulmonary function tests, arterial blood gas, chest x-ray as indicated
Gastrointestinal	↓hepatic size and blood flow			
Renal	↓glomerular filtration and tubular function			BUN, small ↑ in creatinine may represent large ↓ in renal function
CNS	↓requirements for sedative/analgesic agents (greater sensitivity and ↓metabolism and clearance); risk of post-sedation delirium may increase with age	presedation mentation		start with a “test dose” of sedative agent

When administering sedative/analgesic agents to the geriatric patient—START LOW, AND GO SLOW—this permits titration of the sedative/analgesic agent to the minimal dose required for the optimal clinical effect.

DISCHARGE CRITERIA

Objectives:

1. To understand the criteria that should be met prior to discharging a patient from the recovery care of procedure-related sedation.

Post-Anesthesia Recovery Score (PARS): an objective score where patients serve as their own control to determine suitability for discharge from the procedure area (inpatients only). For outpatients, the PAR Scoring System (Table 1) is used with additional criteria.

Recovery and Discharge-A written record of parameters monitored in the recovery phase should be maintained. The patient's status at the time of transfer to the recovery area must be noted. The patient must be assessed immediately prior to discharge from the recovery area and meet specified criteria (see below) before being discharged. A discharge order must be entered in the medical record by a licensed independent practitioner or resident who has completed competency training in procedure-related sedation or registered nurse/nurse practitioner by standardized procedures, who participated in, or is familiar with, the care of the patient. For moderate sedation, the patient may be discharged after telephone communication between the nurse in the recovery area and the licensed physician, in which event the medical record must reflect the telephone order and must specify the licensed physician giving the order.

1. Patients will be discharged from the recovery area when they have achieved a total PARS of at least 8 or baseline PARS (see below). This scoring system addresses respiration, circulation, level of consciousness, activity, and skin color. Patients who do not achieve a Total Assessment Score of at least 8 must be evaluated by a physician prior to discharge.
2. Patients will be monitored for at least 30 minutes after the last intravenous administration of any drug, or 60 minutes after the last oral or intramuscular drug administration.
3. Patients receiving narcotic or benzodiazepine antagonists will require monitoring until it can be assured that re-narcotization or re-sedation will not occur.
4. The *Sedation Record* will document that post-procedural instructions have been delivered and understood.
5. A record of the drugs and fluids administered and the monitored parameters will be kept on the *Sedation Record*. This form will become a permanent part of the medical record.
6. Discharge Criteria: Patients will be discharged from the recovery area when they have met the criteria outlined below.

Table 1-Post-Anesthesia Recovery Score.

	Score—Response (Adult)	Score—Response (Pediatric)
Activity	2 —can move 4 extremities 1 —can move 2 extremities 0 —cannot move extremities	2 —moves purposefully 1 —moves to command or to light tactile stimulation 0 —does not move
Respiration	2 —able to deep breath 1 —limited breathing 0 —apnea	2 —able to deep breath 1 —limited breathing 0 —apnea
Circulation	2 —blood pressure \pm 20 mmHg of baseline 1 — blood pressure \pm 20-50 mmHg of baseline 0 — blood pressure \pm 50 mmHg of baseline	2 —blood pressure \pm 20% of baseline 1 — blood pressure \pm 20-50% of baseline 0 — blood pressure \pm 50% of baseline
Neurologic Status	2 —fully awake 1 —arousable 0 —not responding	2 —fully awake 1 —arousable 0 —not responding
Color	2 —pink SaO ₂ >95% 1 —pale/blotchy SaO ₂ >90-95% 0 —cyanotic/dusky SaO ₂ <90%	2 —pink SaO ₂ >95% 1 —pale/blotchy SaO ₂ >90-95% 0 —cyanotic/dusky SaO ₂ <90%

Discharge Guidelines

From Recovery Phase to Other Hospital Areas

- a. Patient has not received an intravenous narcotic, sedative or anxiolytic for 30 minutes; or similar intramuscular or oral medication for 60 minutes.
- b. Stable vital signs documented over a period of at least 30 minutes (which may include the procedure) since the last intravenous sedation was administered, or 60 minutes since the last intramuscular or oral medication.
- c. Adequate ventilation and oxygenation as evidenced by stable unlabored respirations, appropriate tidal volumes and an oxygen saturation appropriate for the patient. (Patients with room air oxygen saturation of less than 90% will be transported with oxygen.)
- d. Mental status will have returned to the preprocedure/presedation state.**
- e. Patient free from undue discomfort caused by the procedure.
- f. Overall physical and mental condition equivalent to that on arrival in procedure unit.

**It is recognized that certain patients will have severe systemic disease, and will arrive in the procedure room in an abnormal state of consciousness or with cardiovascular abnormalities. Discharge of these patients back to their units or nursing areas will require consultation with the receiving physician, and transport will be made with physician or RN supervision and accompaniment.

Discharge from Hospital to Home

- a. Patients must have met inpatient recovery area discharge criteria (see above) and be capable of assuming limited daily activities.
- b. The vital signs, i.e., pulse, blood pressure and respiratory rate should be stable and at their baseline values.
- c. Adequate respiratory function should be demonstrated by the ability to maintain a clear airway, generate a forceful cough, and by the presence of clear lung fields to auscultation.
- d. Mental status must have returned to the preprocedure/presedation state.
- e. The patient should demonstrate normal color and distribution color of skin, mucosa and nail beds.
- f. The patient should be able to stand upright and ambulate as appropriate for age and condition.
- g. The patient should be able to swallow and retain oral fluids.
- h. The patient should be able to void when applicable.
- i. There should be no abnormal bleeding or undue discomfort from the surgical site.

Procedure for Discharge

- a. The recovering nurse will notify the appropriate physician when the patient appears to meet the discharge criteria.
- b. A discharge order must be entered in the medical record by a licensed physician who participated in, or is familiar with, the care of the patient. Alternatively, for patients who received moderate sedation, the patient may be discharged after telephone communication between the registered nurse in the recovery area and the licensed physician, in which event the medical record must reflect the telephone order and must specify the licensed physician giving the order.
- c. Post-procedural printed instructions will be given to the patient and the nurses' notes will document that they have been received and understood.
- d. A number to call in the event of complications will be provided to the patient.
- e. The patient will be discharged directly to the supervision of an adult sponsor who will accompany the patient to his/her home or place of lodging.
- f. The patient shall be instructed not to operate a motor vehicle for 24 hours.
- g. Patients will not be discharged unaccompanied into a taxicab or public transportation vehicle unless approved by the written order of a physician. Unaccompanied discharge is to be discouraged.
- h. Disposition arrangements for a patient who fails to meet hospital discharge criteria will be documented in the medical record by a physician.
- i. The nurse will document the date and time of discharge, patient's condition on discharge and any prescriptions or appliances given to the patient.

Name: _____ **Date:** _____
Mailing Address: _____ **Specialty:** _____
_____ **Phone:** _____
_____ **Fax:** _____

DEEP SEDATION TEST QUESTIONS

The Study Guide is provided for those physicians eligible to apply for **Deep Sedation** privileges. The Study Guide is approximately 41 pages, so you may consider printing only the Test and reviewing the Study Guide on-line.

Once you have **completed the test**, please **fax it to Medical Staff Administration** at (909) 558-6053 (x66053). Your test will be graded and a certificate faxed to those passing the test with a score of 45 correct or more. Please be sure to complete all the information at the top of this test.

1. During a minor procedure under sedation and analgesia, the patient is breathing slowly with some snoring, is not easily aroused, and does not respond to verbal commands. At which level of sedation is this patient?
 - a. twilight sedation
 - b. moderate sedation
 - c. deep sedation
 - d. irreversible sedation

2. Which of the following defines moderate sedation?
 - a. a medically controlled state of depressed consciousness from which the patient does not respond to verbal or tactile stimuli
 - b. CNS depression produced by sedatives and/or analgesics that allow patients to tolerate unpleasant procedures while maintaining the ability to respond to verbal or tactile stimuli
 - c. the administration of morphine to treat post-operative pain
 - d. the administration of a sedative/hypnotic agent to facilitate sleep

3. Patients being evaluated for procedure-related sedation need:
 - a. a history and physical.
 - b. an ASA physical status assignment
 - c. a consent
 - d. all of the above

4. All of the following are monitoring requirements for the sedated patient EXCEPT:
 - a. blood pressure
 - b. capillary refill
 - c. pulse oximetry
 - d. respiratory rate

Name: _____

Date: _____

Specialty: _____

DEEP SEDATION TEST QUESTIONS

5. A 7 year old is to have a lumbar puncture performed using sedation. The minimum number of qualified personnel who should be available during the procedure is:
 - a. One (the physician to perform the procedure and to monitor the patient)
 - b. Two (the physician to perform the procedure and another to monitor the patient)
 - c. Two (the physician to perform the procedure and monitor the patient, and another to assist)
 - d. Three (the physician to perform the procedure, an aide to restrain the patient, and a RN to assist the physician with the procedure)

6. What equipment must be used or available for patient monitoring during procedure related sedation?
 - a. hospital code blue cart
 - b. defibrillator
 - c. functional self-inflating bag and mask system
 - d. all of the above

7. What parameter must be monitored continuously during sedation:
 - a. state of consciousness
 - b. pulse oximetry
 - c. blood pressure
 - d. cardiac output

8. The first and most important action when a patient starts to vomit during a procedure is to:
 - a. apply restraints
 - b. give supplemental O₂
 - c. give a reversal agent
 - d. reposition to lateral decubitus

9. The first response for an obstructed airway is to:
 - a. suction the patient
 - b. intubate the patient
 - c. insert an oral airway
 - d. perform a chin lift/neck extension

10. Versed is an anxiolytic drug. This means that it:
 - a. provides analgesia
 - b. reduces anxiety
 - c. reduces blood pressure
 - d. increases anxiety

Name: _____

Date: _____

Specialty: _____

DEEP SEDATION TEST QUESTIONS

11. Guidelines for patients at discharge after sedation should include:
 - a. written release of the hospital from responsibility
 - b. discussion of all potential adverse effects of moderate sedation
 - c. discussion of the effects of sedation and a warning about operating a motor vehicle
 - d. a mandatory follow-up visit with the physician who performed the procedure

12. Which of the following statements about the use of benzodiazepines for moderate sedation is true?
 - a. adjustment in dosing is needed when giving an opioid
 - b. should always be reversed by flumazenil
 - c. should always be reversed by naloxone
 - d. should always be given by the oral route

13. For short procedures, midazolam is a better choice than diazepam as an anxiolytic.
 - a. True
 - b. False

14. Which of the following statements about opioids and apnea is true?
 - a. responsive patients can become apneic, especially with rapid intravenous administration of opioids
 - b. apnea is an unlikely, uncommon adverse reaction
 - c. apnea doesn't usually lead to cardiac arrest
 - d. apnea doesn't occur, since the main effect of opioids is analgesia.

15. Which of the following statements about using naloxone (Narcan) to reverse opioid effects is true?
 - a. it should be given in a continuous IV drip without boluses
 - b. it can induce narcotic withdrawal
 - c. it is absent side effects
 - d. it does not antagonize the respiratory effects of opioids.

16. Which of the following statements regarding naloxone is correct?
 - a. it reverses the respiratory depressant effects of fentanyl
 - b. it reverses the respiratory depressant effects of midazolam
 - c. it can only be given by IV push
 - d. it reverses the respiratory depressant effects of chloral hydrate

Name: _____
Specialty: _____

Date: _____

DEEP SEDATION TEST QUESTIONS

17. Which of the following statements are true?
- naloxone can be used to reverse narcotic overdose.
 - flumazenil can be used to reverse narcotic overdose.
 - flumazenil can be used to reverse ketamine overdose.
 - naloxone can be used to reverse barbiturate overdose.
18. Factors associated with an increased incidence of emergence delirium in association with ketamine include:
- age >16 years
 - female sex
 - doses of ketamine >2 mg/kg IV
 - history of personality problems or frequent dreaming
 - all of the above

For items 19-23, select the letter of the medication that best matches the statement describing the drug:

- fentanyl (Sublimaze)
- midazolam (Versed)
- flumazenil (Romazicon)
- DPT Cocktail (demerol, phenergan, thorazine)
- meperidine (Demerol)

19. _____ It's 100 times more potent than morphine.
20. _____ Is not recommended for use by the *American Academy of Pediatrics*.
21. _____ Is contraindicated in patients on monoamine oxidase inhibitors.
22. _____ Should not be given to patients on chronic benzodiazepine therapy.
23. _____ It's more potent than diazepam (Valium).
24. B.M. is a 70 year old male with renal dysfunction and history of epilepsy. He is scheduled to go to the endoscopy lab in the morning. He states that he got a mild rash when morphine was given to him. The best choice of medications for moderate sedation for him is:
- meperidine 100 mg IV 30 minutes prior to procedure, followed by diazepam IV 10-15 mg
 - ketorolac 60 mg IV 30 minutes prior to procedure, followed by midazolam 2.5 mg IV
 - fentanyl 50 mcg IV, followed by midazolam 1 mg IV
 - morphine 10 mg IV 30 minutes prior to procedure, followed by midazolam 1 mg IV

Name: _____

Date: _____

Specialty: _____

DEEP SEDATION TEST QUESTIONS

25. When using a bag-valve mask, providers must pay special attention to:
- maintaining a specific ventilatory rate
 - pressing down on the mask in order to prevent leaking of the delivered volume
 - volume of air moved with each squeeze of the bag as assessed by chest movement and auscultation
 - the supplemental oxygen flow rate
26. Infants and small children are particularly susceptible to complications during sedation. The unique anatomy of which body system contributes to this susceptibility:
- neurological
 - gastrointestinal
 - respiratory
 - renal
27. A Post-Anesthesia Recovery Score is:
- an objective measure used to determine a patient's suitability for discharge
 - the same as an ASA Physical Status Classification
 - a neurological assessment of LOC
 - a physician test of how well a patient will tolerate narcotics
28. Who can discharge patients to home or elsewhere after procedure-related sedation?
- the physician performing the procedure or the nursing performing the monitoring
 - a licensed physician only
 - a licensed physician or a registered nurse functioning under standardized procedures
 - all of the above

Mark True or False for the following questions:

29. T F A patient that is moribund and not expected to survive the procedure is an ASA physical class I patient
30. T F In otherwise healthy patients, the duration of NPO for solids is at least six hours
31. T F Barbiturates are the preferred method of sedation for most patients undergoing a procedure.
32. T F Ketorolac is safe in patients that are hypovolemic.
33. T F Nitrous oxide is contraindicated in patients with a pneumothorax
34. T F Naloxone has a long half-life with little chance of renarcotization when used for opiate-induced respiratory depression.
35. T F On preliminary examination of the oropharynx, the uvula is not visualized. It is likely, if endotracheal intubation is required, that it will be difficult

Name: _____ Date: _____
Specialty: _____

DEEP SEDATION TEST QUESTIONS

36. T F During sedation the jaw may relax and the base of the tongue may fall back in contact with the posterior pharynx and result in obstruction. Often a simple realignment of the airway may correct this problem.
37. T F When administering sedation in pediatric patients, it is important to administer a large, single dose of the agent(s) for rapid effectiveness
38. T F Geriatric patients have an increased requirement for sedative/analgesic agents.
39. T F In order for patients to be discharged from the recovery phase after procedure-related sedation, they must achieve a PARS of 3.
40. T F When patients are discharged to home for recovery after procedure-related sedation, they are encouraged to be unaccompanied in order to cut costs.

Risk factors that are most consistently associated with a difficult airway are:

41. T F obesity
42. T F decreased head and neck movement
43. T F receding mandible
44. T F reduced jaw movement
45. T F protruding teeth

Treatment of laryngospasm should include

46. T F 100% oxygen
47. T F removing any painful stimulus
48. T F jaw thrust
49. T F positive airway pressure
50. T F nothing-laryngospasm is usually transient and goes away if the patient is left alone

